Green House Gas reduction strategies in OECD countries

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Abstract

This paper shows Outline of international research project for Green House Gas (GHG) reduction strategies. This research project is conducted by researchers from 18 OECD countries. Road Transport is the most important issue for economies and welfare of people. Freight transport is result and process of economic activities. Passenger transport is result of business and welfare of people. Increasing speed of GHG from transport sector has been more than total GHG, in most country in the world. GHG reduction should be attained through Economic growth. This research project suggests the way to attain both GHG reduction and Economic growth. In this paper we propose Structure of GHG reduction strategies and good practices in OECD countries. Section 1 is situation of Global Warming and Relationship between GHG and Transport Sector. Section 2 is framework of GHG reduction strategies. Section 3 is Marginal Abatement Costs of GHG reduction measures. Section 4 is good practices in OECD counties. Section 5 is how to make national strategy for GHG reduction.

1. Background

World GHG emissions have been increasing rapidly. The fourth IPCC assessment report in 2007 concludes that the unequivocal and accelerating warming trend observed since the mid-20th century is very likely due to the observed increase in man-made greenhouse gas (GHG) concentrations. In addition, the transport sector accounts for about 20% of the world CO_2 emissions. Therefore the GHG emission reduction is a worldwide urgent issue. In view of this situation, "Working Grope on GHG Reduction Strategies in the Transport Sector" was formed as one of the research programs of the OECD/International Transport Forum (ITF) Joint Transport Research Center (JTRC) in the period of 2007 to 2009.

2. Mechanism of CO_2 Emissions in Transport Sector

A CO_2 emission process consists of four major stages such as inducing of transport demand, modal choice, fuel choice, and fuel efficiency. The first two stages are on the transport demand side, and the remaining two stages are on the supply side. It has been generally considered difficult so far to decouple CO_2 emissions of the transport sector from the economic growth, because transport CO_2 is emitted by traffic phenomena to be induced from social and economic activities. In light of this situation, to achieve environmentally sustainable transport system based on the CO_2 emission process mentioned above, it is important to clarify the present CO_2 emission characteristics in the countries concerned.

3. Evaluation Model for CO_2 Emissions in Transport Sector

The working group (see Chapter 1) has proposed a transport CO_2 emission evaluation model (see Figure 1) based on the mechanism of transport CO_2 emissions. This model shows that the five factors on the right side of the equation affect the transport CO_2 emissions and how much each of the factors contributes to the emissions. Meanings of the factors on the right side are as follows.

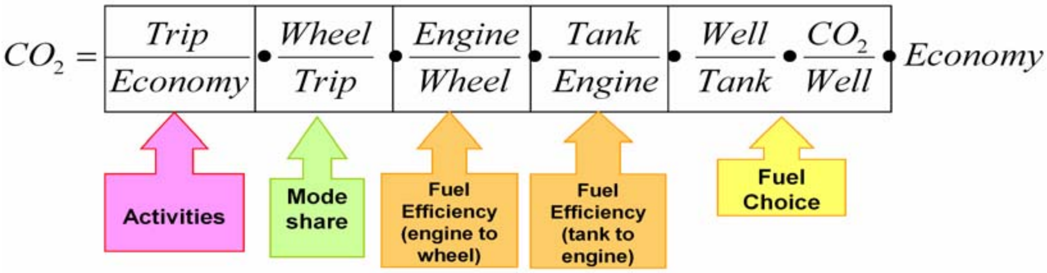

Figure 1 Evaluation Model for CO2 Emissions in Transport Sector Reference 1)

i) Activities:

Environmentally sustainable transport system is realized by managing of transport demand (Passenger-Kilometers and Ton-Kilometers) through promotion of compact city policy even if “Economy (GDP)” grows up.

ii) Mode share:

CO_2 emissions can be reduced by a shift to energy efficient transport and improvement in load factor of vehicle transport even if transport demand (passenger-kilometers and ton-kilometers) increases.

iii) Fuel efficiency:

CO_2 emissions are reduced by improvement in fuel efficiency of vehicles and by smoothing of traffic flow even if vehicle-kilometers increase.

iv)Fuel choice

CO_2 emissions can be reduced by a shift from high carbon intensity of fuels to low carbon intensity of fuels.

4. Methodology of Macroscopic Analysis

Relationship between molecules and denominators of the factors on the right side of the evaluation model (see Figure 1) is analyzed by using various statistics data. In addition, the factor of “Fuel Efficiency” of the model is divided into two stages of “engine to wheel” and “tank to engine”. However the factor consisting of the two stages is analyzed as a whole due to a limit of the concerned data availability. Further vehicle gasoline is used as an indicator for “Well” in the model.

5. Analysis Results of CO_2 Emission Characteristics

5.1 Activities

(1) Relationship between GDP and Passenger-Kilometers*

Though GDPs of Germany (DEU), Japan (JPN) and Italy (ITA) grew from 2000 to 2005, their passenger-kilometers decreased during this period. The United States (USA) and Australia (AUS) cannot adjust passenger transport demand compared to other countries, but Japan, United Kingdom (UKD), France (FRA) and Germany can adjust the demand (see Figure 2).

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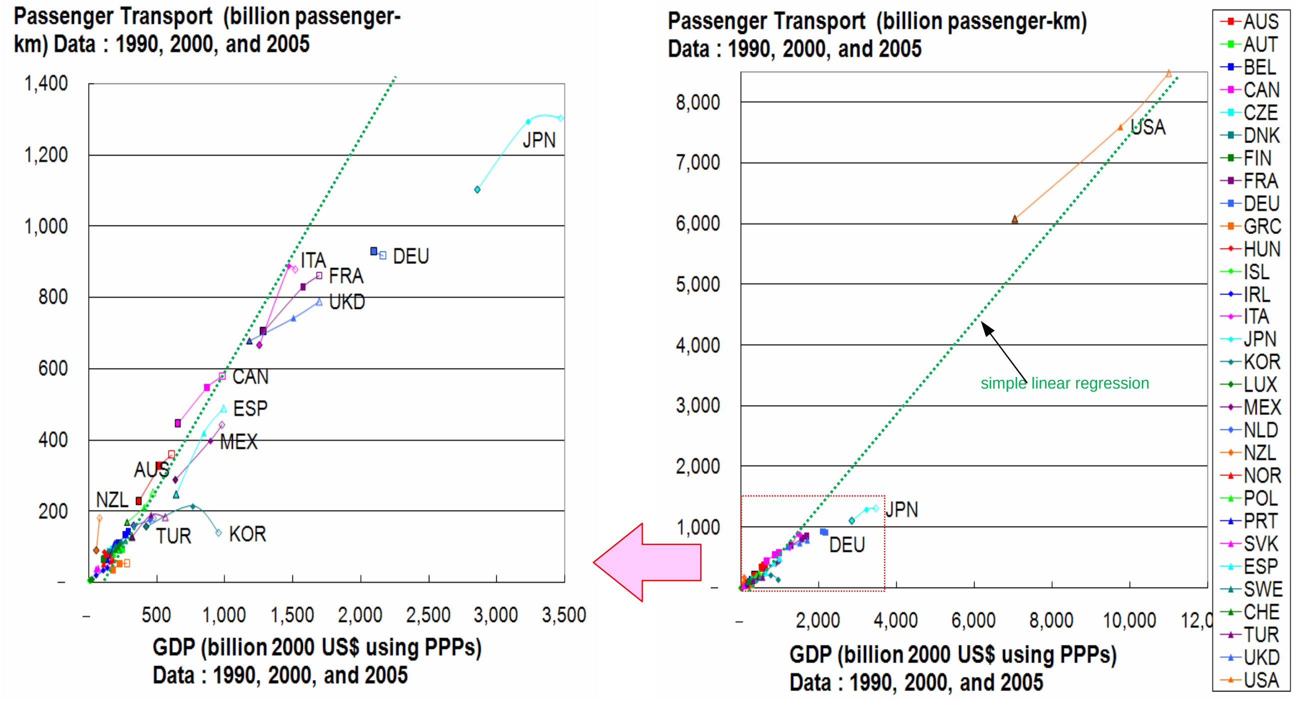

Figure 2 GDP and Passenger-Kilometers Reference : 2) , 3)

(2) Relationship between GDP and Ton-Kilometers**
The United States, Australia and Canada (CAN) cannot adjust freight transport demand compared to other countries, but Japan, United Kingdom, France, Italy and Germany can adjust the demand (see Figure 3) .

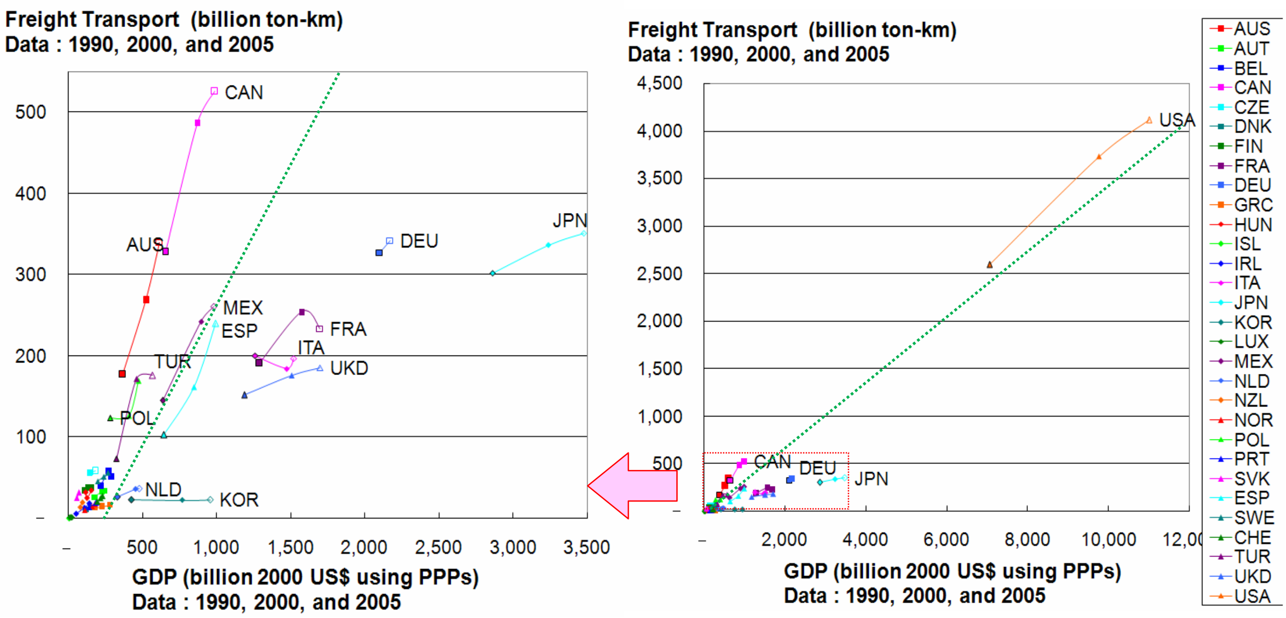

Figure 3 GDP and Ton-Kilometers Reference : 2) , 3)

5.2 Mode share

(1) Relationship between Passenger-Kilometers* and Vehicle-Kilometers of Passenger Transport

An increase rate of vehicle-kilometers of passenger transport against passenger-kilometers in Japan and Italy is high compared to other countries from 2000 to 2004. This is due to an increase in utilization rate of passenger cars. The utilization rate of passenger cars in UK and Germany is high compared to other countries, but it is low in Japan, France, Mexico (MEX) and Spain (ESP) (see Figure 4).

(2) Relationship between Ton-Kilometers of Road Sector and Vehicle-Kilometers of Freight Transport

An increase rate of vehicle-kilometers of freight transport against the ton-kilometers of road sector in France and UK is slightly high compared to other countries from 2000 to 2005 (2004). This is due to the decrease in transport efficiency of freight trucks. The load factor of freight trucks in Japan, France and UK is low compared to other countries, but it is high in Turkey (TUR), Mexico and Spain (see Figure 5).

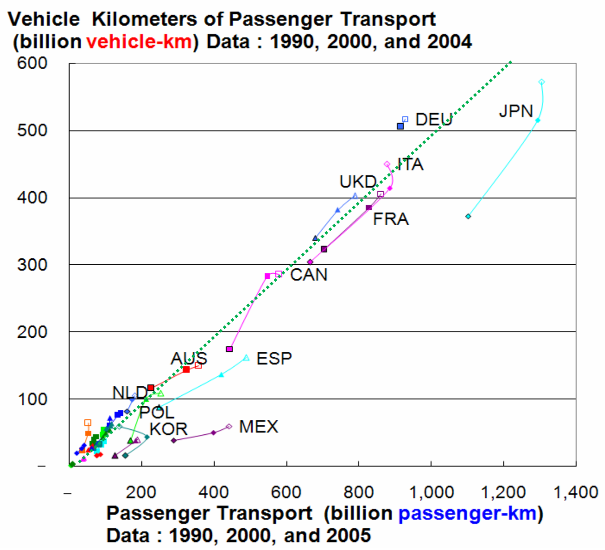

Figure 4 Passenger-Kilometers and Vehicle-Kilometers of Passenger Transport Reference 2)

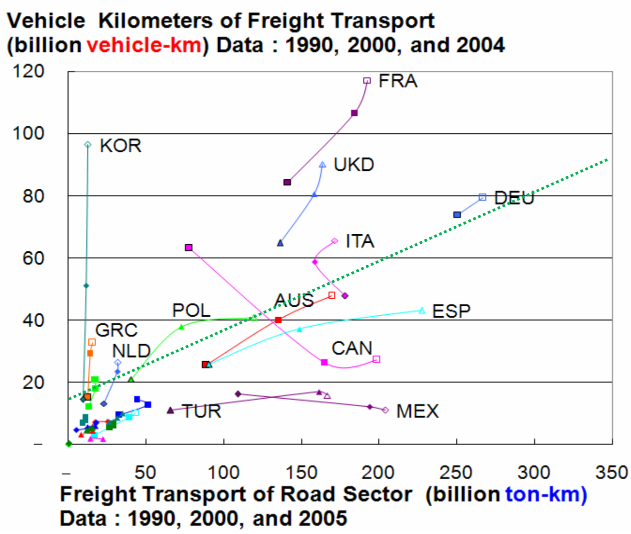

Figure 5 Ton-Kilometers of Road Sector and Vehicle-Kilometers of Freight Transport Reference 2)

5.3 Fuel Efficiency

(1) Relationship between Vehicle-Kilometers of Road Sector and Consumption of Road Fuels***

Much road fuels are consumed against vehicle-kilometers of road sector (poor fuel economy) in Mexico, Spain, Canada and Korea (KOR) compared to other countries, but better fuel economy is observed in Japan, Germany, France UK and Italy (see Figure 6).

5.4 Fuel choice

(1) Relationship between Consumption of Road Fuels and Consumption of Motor Gasoline

A rate of motor gasoline consumed against road fuels consumed of Canada and Mexico is high compared to other countries, but it is low in Japan, France, Italy, and Spain (see Figure 7).

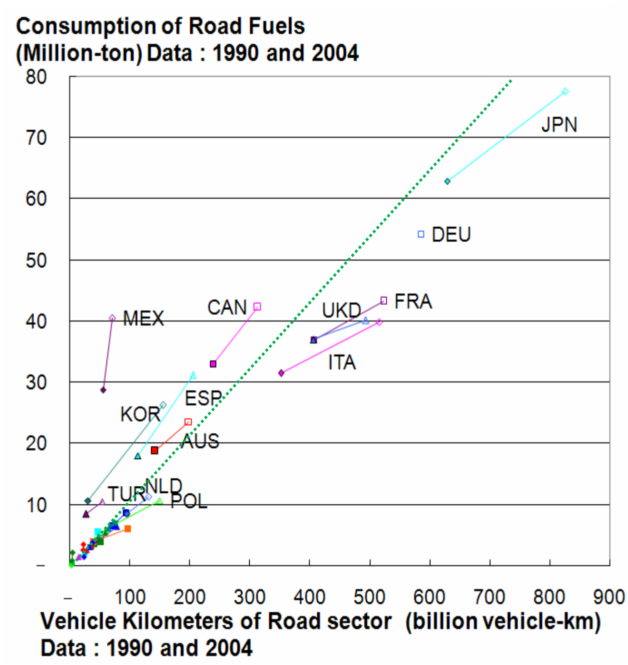

Figure 6 Vehicle-Kilometers of Road Sector and Consumption of Road Fuels Reference 2)

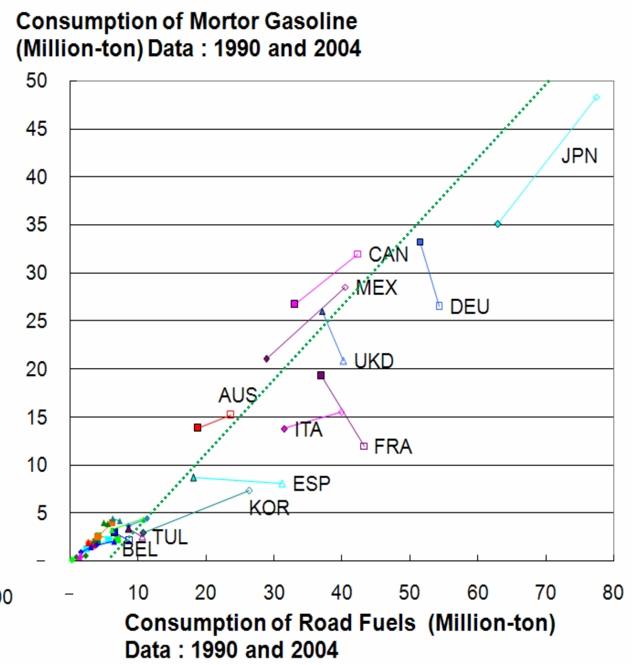

Figure 7 Consumption of Road Fuels and Consumption of Motor Gasoline Reference 2)

* There are no data available for shipping.

** Data of inland waterways are not used because they do not include domestic maritime shipping

***Consumption of Road Fuels are total of Gasoline, Diesel Oil, LPG, Natural Gas and. Liquid Biomass. In addition, there are no data available for Hydrogen and Electricity.

6. Conclusions

Rough characteristics of transport CO_2 emissions of OECD countries have been clarified by the macroscopic analysis based on the evaluation model proposed. Further research is required to refine the proposed model for making it a common tool in evaluation of transport CO_2 reduction efforts of the countries concerned.

References

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